7.0 POTENTIAL IMPACTS ANALYSIS

7.1 INTRODUCTION

Chapter 7 evaluates the potential for impacts resulting from the construction and operation of the Longhorn Pipeline System (System). Construction impacts are defined to include ground-disturbing activities associated with the new lines near El Paso and along the Odessa lateral, as well as work at the pump stations. Operational impacts are associated with the transport of gasoline and other liquids through the pipeline.

For the purpose of the Environmental Assessment (EA), adverse and beneficial impacts of the System are assessed as potentially “significant,” “major,” “minor,” “short-term,” “long-term,” “irretrievable,” and/or “unavoidable.” Environmental baseline data are derived from Chapter 4, along with identification of sensitive receptors. Information on incident risks, including gasoline and crude oil specifications, is based on information in Chapters 5 and 6.

Short-term impacts are those impacts related to the first five years of the project when vegetation is removed, soil is disturbed, the affected environment is reclaimed, and vegetation is re-established. Long-term impacts are those that commit the use of the environment for the 50-year life of the project. Chapter 9 addresses the mitigation of impacts identified in this chapter.

7.1.1 Impacts Classification

The impacts that could result from the operation of the pipeline were evaluated by category: human impacts, ground water, geology, soils, aquatic biology, terrestrial biology, surface water, air quality, transportation, land use, and noise.

For the impact categories most critical to this EA, particularly those categories specified in the Settlement Agreement, there are additional subcategories. For example, ground water impacts to agricultural use, drinking water supply, and recreational use were evaluated separately.

7.1.2 Event Types

Five types of events were studied for each impact category and subcategory identified. Four of these are associated with pipeline operation; the fifth is related to construction. Event types are:

- Normal operation;

- Small persistent leak;
- Large instantaneous leak;
- Large leak plus ignition; and
- Construction.

7.1.3 Evaluating Impacts

It is not possible to predict “no impact” absolutely, or characterize all types of possible impacts. There are potential impacts, such as the possibility of a release in certain areas causing a taking of one or more members of a threatened or endangered species, which may be considered major if they were very likely to happen. Final consideration of acceptable levels of risk requires understanding both the probability and the impact associated with an incident.

Major effects common to most resource categories include:

- The difference between impacts due to gasoline and crude oil;
- The difference in impacts involving ignition of the release versus a simple release without ignition; and
- The different impact mechanisms posed by a small persistent leak versus a large instantaneous leak.

Overall determination of whether an impact is minor or major depends on:

- The probability of an impact occurrence as presented in Chapter 6;
- The consequences of an impact occurrence; and
- The liquid (crude oil or gasoline) that may be transported in the pipeline.

Because the primary interest is in the *consequence* of the impacts, it is separated from the *probability* function in the decision-making. For example, a very major consequence (e.g., a large leak to an important aquifer) might have a low probability, while a minor impact (e.g., volatile emissions from pumping stations) might have a high probability.

7.1.3.1 Gasoline versus Crude Oil

The potential impacts posed by transporting the mix of refined products (referred to as gasoline) and crude oil are similar in nature, though they are not identical. This is due both to differences in the chemical composition and in the physical nature of gasoline and crude oil. The potential impacts posed by transporting refined products and crude oil are similar in nature, but they have different movement characteristics in ground water because of the differences in chemical and physical composition and type of aquifer.

Gasoline has a higher benzene content than crude oil. For the modeling exercises associated with this EA, a concentration of 0.14 percent benzene was assumed for crude oil, while 4.9 percent benzene was modeled for gasoline. This difference is important because benzene is the primary toxic constituent in gasoline. Four aromatic hydrocarbons — benzene, toluene, xylene, and ethylbenzene (BTEX) — are found in gasoline at concentrations greater than 1.0 percent by weight. Of these constituents, benzene has the lowest maximum contaminant level (MCL) for public drinking supplies in Texas, at 5 parts per billion (ppb), two orders of magnitude lower than the next lowest constituent (ethylbenzene, at 700 ppb)[1].

The physical characteristics of gasoline versus crude oil and, in particular, the characteristics of benzene and methyl tertiary-butyl ether (MTBE) in gasoline, will greatly affect movement of gasoline relative to crude oil in some environmental media. Gasoline has a lower specific gravity, and a lower viscosity, than crude oil. The large percentage of heavier weight organic constituents and the high viscosity of crude oil will limit its spreading (PBS&J, 1998). Gasoline, which contains a high percentage of lighter or monoaromatic hydrocarbons, will tend to evaporate in the air and dissolve into water at a higher rate and concentration. A release of gasoline will spread out rapidly due to low viscosity and high solubility. During a release, lateral transport of gasoline components is more common than vertical transport (Davidson, 1998).

In addition to contributing to gasoline's viscosity, specific gravity, and solubility, benzene, as well as xylene, can substantially increase the permeability of clay. These chemicals can cause clay shrinkage and cracking, thereby increasing the chances of fracturing clay soils in the upper horizons and providing pathways for gasoline to move more rapidly to subsurface aquifers than might otherwise be indicated (Ross, 1998).

According to Longhorn, the gasoline that would be transported by Longhorn may contain up to 15 percent by weight MTBE. MTBE is a known nuisance factor at very low concentrations in drinking water, giving an unpleasant odor and taste to the water. Taste and odor thresholds for MTBE range from 2.5 ppb to 680 ppb and 2 ppb to 190 ppb, respectively (State of California Health and Environmental Assessment of MTBE). In response to this threshold, the California

[1] The Texas Natural Resource Conservation Commission (TNRCC) has established Standards of Chemical Quality for drinking waters in the state, published in the 30 Texas Administrative Code (TAC) Part I, Chapter 290, Section 290.103.

Department of Health Services has proposed a secondary maximum contaminant level for MTBE of 5 ppb. The State of Texas has not proposed or recommended criteria for MTBE, but the U.S. Environmental Protection Agency (EPA) recommends “keeping levels of contamination in the range of 20 to 40 µg/L (ppb) or below to protect consumer acceptance of the water resource” (EPA, Drinking Water Advisory).

Despite the nuisance threshold, MTBE is not likely to pose a health risk to the public. At 20 ppb in water, the EPA estimates that a safety factor of 40,000 exists for cancer effects and over 100,000 exists for some non-cancer effects. This means that the concentration at which MTBE yields an unpleasant odor or taste is 1/40,000 of the concentration at which health effects could occur. The implication is that people will stop drinking MTBE-contaminated water at concentrations before it reaches a level that would pose serious health effects.

The presence of MTBE in a contaminant plume can affect the transport characteristics of the plume. MTBE has a very high solubility in water, much higher than benzene has, a low affinity for organic carbon, and a low volatilization when dissolved in water. MTBE is also relatively resistant to biodegradation. If a release occurs, MTBE may move quickly and flow more freely to reach ground water or surface water than organic constituents found in gasoline, whose transport may be retarded by preferential sorption onto organic matrices, volatilization, and/or biodegradation (Davidson, 1998).

In the unlikely event of a release to an aquifer, characteristics of MTBE will allow it to move ahead of benzene and other contaminants in the ground water — it is possible over time that a plume of MTBE-contaminated ground water will even detach from a benzene-contaminated plume. Therefore, it will often be the most downgradient contaminant and the first to reach a drinking water well or a surface water intake (Davidson, 1998). Because of this characteristic, and because of MTBE’s offensive taste and odor, it can often serve to warn a potable-well user about subsurface contamination before the arrival of more toxic aromatic hydrocarbons from a blended gasoline spill.

On July 27, 1999, based on the findings of an advisory panel that MTBE can cause foul smell and taste, and can pose risks to water supplies, the EPA Administrator called for a significant reduction in the use of MTBE in gasoline as soon as possible[2].

[2] Blue Ribbon Panel of Experts commissioned on November 30, 1998, to study the effects of MTBE in drinking water supplies.

Based on these factors, impacts from specific events were projected differently for gasoline and crude oil, as follows:

- Gasoline may have higher impacts to drinking water for both ground water and surface water, because of the effects of benzene and MTBE, and because transport characteristics make it more likely to reach a drinking water source in the event of a release.
- Crude oil may have slightly higher impacts to long-term water quality in ground water, because the higher viscosity, sorbability, and specific gravity make a crude oil release more likely than gasoline to sink deeper into the ground water column, to resist natural dilution and transport through flushing, and to be less likely to volatilize. This difference in impact varies by aquifer type.
- Except in those potential cases involving ignition, crude oil may have greater impacts to long-term land use than gasoline. In the absence of an ignition, a large crude oil release would result in more severe long-term impacts to land use because of the slower movement rates and absence of the volume removal effects of volatilization.
- If ignition occurs, gasoline will impact a larger radius and potentially cause more damage to land use.
- Gasoline is more likely to ignite than crude oil, and because of the rapid heat release and the wider area of spread from a comparable volume released, a gasoline fire would be expected to result in greater damage than a fire involving crude oil.

7.1.3.2 Ignition

Leaks involving an ignition and fires are evaluated separately from other leaks of comparable size. The primary differences in impacts between these two types of leaks are as follows:

- Fires create an immediate threat to human health and safety, and to property;
- Fires reduce the volumes of released gasoline or crude oil, and therefore reduce contamination of water resources;
- Fires associated with spills over rivers or streams can cause fish mortality in the area of the fire and downstream, due to changes in water temperature and because surface water fires can consume dissolved oxygen in the water; and
- Fires increase air quality impacts temporarily due to release of combustion byproducts.

7.1.3.3 Small Leaks versus Large Leaks

Intuitively, the impacts from large instantaneous leaks, such as would occur during a line rupture, would be more severe than the impacts from a small leak. However, small leaks can occur for a considerable amount of time without detection, possibly releasing contaminants as much or more than a large leak would, the primary difference being the duration of the event. In the worst case, a small leak would remain below the sensitivity of the leak detection system and undetected until an actual environmental impact was discovered along the pipeline.

Because of this phenomenon, and because large instantaneous leaks and smaller persistent leaks have different probabilities associated with them, these types of events were evaluated differently for each sensitive receptor. In general, large leaks can be expected to provide a greater impact on drinking water supplies because the contaminants are expected to reach the drinking water supplies at much higher concentrations. A small persistent leak may contaminate a drinking water well, for example, but not cause an exceedance of the thresholds for MTBE or benzene.

It is difficult to determine whether a small persistent leak or a large leak will result in greater impacts in every instance. A larger leak may overwhelm a hydrologic system's capacity and drive contaminants deeper into the aquifer or to organic matrices. An instantaneous event is more likely to be detected and responded to in a timely fashion and, therefore, more of the contaminants may be contained and removed or remediated before they reach more sensitive receptors. Both of these possibilities, neither of which can completely be characterized or predicted ahead of time, could have a large impact on the long-term consequences of an event.

Large instantaneous leaks are expected to have greater impacts on species of concern along the pipeline than would occur from small persistent leaks. Many of these species have limited habitat available, and damage to that habitat, even in the short term, may cause irreversible losses in population.

7.2 HUMAN IMPACTS

7.2.1 Introduction

Impacts to human resources which may result in the event of a release of product, fire, or explosion were evaluated. Although such an event, or series of events, is unlikely to occur, property damage, reduced property values, injuries, or death could occur. The risk of a fire has already been present due to past uses of the pipeline. Releases from gasoline pipelines are twice as likely to ignite as crude oil pipeline releases, primarily because of the higher vapor pressure of gasoline.

The focus of this section is on identifying potential impacts on populated areas and other sensitive receptors along the line that are within a specific distance of the pipeline. A density of 20 or more residences per mile is used to define sensitive areas as a gross probabilistic tool. This density is not intended as a measure of the number of people who could be injured in a gasoline or crude oil fire. Where the residential density is currently lower, a fire along the pipeline is less likely to impact an existing residence. Table 7-1 includes a listing of those areas along the pipeline that are sensitive for potential impacts to population, based on the methodology described below. Table 7-2 includes a sub-listing of those areas which are hypersensitive for population, based on a definition of 100 residences per tenth of a mile.

7.2.2 Potential Impacts

7.2.2.1 Quantification of Risks

As discussed in Chapter 6, ignition of gasoline spills is expected to be an improbable occurrence. Explosions are even more improbable.

Along the 723-mile length of the pipeline, over the 50-year project life, the probability approaches 1.0 (99.3%) that a large [5,000 barrel (bbl)] instantaneous spill will occur at some point. For any individual 2,500-foot segment of pipeline, there is a 1 in 16,200 probability of a spill of 5,000 bbl or larger per year. Since the pumping stations are not located in population sensitive areas, the public safety risks of leaks at pumping stations are not considered here.

Only a fraction of leaks will reach the surface and present an ignition potential; additionally, only a fraction of those leaks will result in some sort of ignition, which requires a spark or open flame before vapors dissipate. Nonetheless, in a densely populated area, there are sources of ignition (e.g., sparks from car engines, grills, cigarettes, careless use of matches). Explosions are much less likely and require confinement of vapors.

7.2.2.2 Zone of Potential Impact

Events involving fires or explosions of gasoline or crude oil releases from the pipeline can result in significant impacts to human health and safety as well as in significant property damages.

The consequences of a fire were modeled at a number of release locations along the pipeline. Numerous scenarios were modeled by varying the type of fire (flash fire versus pool fire), the volume of the release (50 bbl, 500 bbl, 1,500 bbl, and site-specific maximum release volume), the fuel (crude oil or gasoline), and for pool fires, the heat generation rate. In the worst case, modeled in a population sensitive area, if a flash fire were to occur, the modeled impact distance is 921 feet from the pipeline for a gasoline leak, and 407 feet from the pipeline for a crude oil fire. A slower burning pool fire could impact a larger distance from the pipeline, but would have a reduced chance of resulting in death or injury because of the greater time available to evacuate the zone of impact. A pool fire could still cause major property damage in some areas.

Explosions that could cause pressure waves and endanger humans or damage property not immediately next to or in the path of the spill were not evaluated for zone of impact because of the lack of confined spaces that could result in explosion along most of the pipeline.

7.2.3 Potential Impacts Analysis

Normal pipeline operation and construction would result in minimal, if any, impacts on humans. However, there is some potential for impacts to human health in the improbable event of a release resulting in a ignition at every point along the pipeline, even in those areas that are not currently densely inhabited.

A large leak, in the absence of a fire, is not expected to cause major direct impacts to human health and safety (indirect impacts, such as health impacts to drinking contaminated water, are discussed in later sections). While there would be some short-term impacts due to inhalation of gasoline fumes, exposure should be limited, as the population would evacuate the area.

A small leak is not expected to cause major direct impacts to human health and safety. Due to the highly volatile nature of gasoline, any conditions that pose risk to human health would become a nuisance, requiring response, before significant health effects were achieved.

Exposure to gasoline fumes from either scenario is expected to be comparable to ordinary exposure to gasoline fumes from vehicle fueling over a long period.

The following areas were identified as being at risk of major health and safety or public property-related impacts if a spill with an ignition were to occur at that point in the pipeline:

- Areas with 20 or more residences per linear mile within 1,250 feet of the pipeline, including urban and suburban areas in the Houston Metropolitan Area, Aberdeen Trails Subdivision in Bastrop County, and urban and suburban areas in the Austin Metropolitan Area;
- Areas with schools and day care facilities within 1,250 feet of the pipeline, including 13 schools and nine day care facilities in the Houston Metropolitan Area, and three schools and two day care facilities in the Austin Metropolitan Area; and
- Areas with health care facilities within 1,250 feet of the pipeline, including Greenway Manor Personal Care, Gulf Bank Medical Center, and Medical Center of East Houston in the Houston Metropolitan Area, and the Brown Schools Rehabilitation Center in south Austin.

Table 7-3 lists and describes the population sensitive areas along the route.

7.2.4 Mitigation Measures

In order to reduce the potential for impacts to human populations, mitigation measures that address pipeline safety are necessary. These measures might include:

- Mitigation measures designed to reduce the overall risk of pipeline failure through testing and, if necessary, repair or replacement of pipe and components in specific areas;
- Mitigation measures designed to locate potential problems during the service life of the pipeline, such as ongoing testing programs and enhanced leak detection capabilities;
- Mitigation measures directed towards prevention of third-party damages in highly populated areas; and
- Mitigation measures aimed at reducing the impacts to health and safety if an accident does occur, such as improved emergency response procedures.

7.3 IMPACTS TO GROUND WATER

7.3.1 Introduction

Throughout Texas, ground water is an important resource of water supply for a few large municipal areas near the Longhorn pipeline route as well as for a number of private drinking water wells. Ground water is also valued as a source of irrigation water, and for watering livestock on many farms and ranches traversed by the pipeline.

Ground water replenishes many of Texas' rivers and streams. Karst formations in much of the central Texas hill country have numerous caves and fissures that readily conduct ground water. The ability of these formations to harbor sensitive biological species is tied to the quality of the ground water they transport. Some of these caves and springs are also considered recreational resources.

Tables 7-1 and 7-2 list aquifer features classified as sensitive and hypersensitive for drinking water quality, and areas where ground water quality can impact sensitive species populations. These areas are described in more detail in Sections 7.4 and 7.5. Also listed are areas where ground water can affect surface water quality, and areas where ground water can impact recreational facilities. These areas are described in more detail in Sections 7.3 and 7.3.3.4

7.3.2 Potential Impacts

7.3.2.1 Quantification of Risks

Releases of crude oil or gasoline from a pipeline are a function of the line conditions and the length of pipeline being evaluated. The likelihood of a large (5,000 bbl or greater) spill occurring along any 1-mile stretch of pipeline is about 1 in 730 over the 50-year pipeline service life. In any given year the risk of a 5,000 bbl leak occurring is about 1 in 7,600. These risks can be scaled to evaluate the risk posed to any specific aquifer feature. For example, the risk of a major spill occurring over the hypersensitive formations of the Edwards Aquifer [Balcones Fault Zone (BFZ)] is about 1 in 210 over the life of the project, and 1 in 2,200 in any given year.

If a large release occurs in a ground water sensitive zone, that still does not ensure that major damages would result to the underlying aquifer formation. For example, despite the two major releases of crude oil that have occurred over the Edwards Aquifer (BFZ) in the past 10 years [one from the Exxon Pipeline Company (EPC) line], no long-term damage to the aquifer in the BFZ, or major impacts to drinking water wells, or to Barton Springs have been documented. This is not to say that no impacts resulted from these events, or that a future release of crude oil or gasoline from the Longhorn pipeline might not result in greater environmental damages due to the specific nature and location of the release. Rather, history suggests that the probability of major damages resulting from a release is lower than the probability of a release itself.

7.3.2.2 Environmental Sensitivity

Subsurface contamination of an aquifer from the pipeline would most likely be caused by an accident within the recharge zone, where the aquifer is unconfined.

The aquifers along the pipeline are described in detail in Chapter 4, with respect to characteristics that determine susceptibility to contamination from a release of gasoline or crude oil from the pipeline. These hydrogeological characteristics include: (1) depth to water; (2) aquifer media; (3) soil development; (4) transmissivity; (5) whether confined or unconfined; and (6) net recharge.

These characteristics are summarized for specific pipeline segments of the pipeline with respect to drinking water supply in Chapter 4. Pipeline segments are defined as those places where changes occur. Thus, for example, a change in hydrogeological sensitivity occurs near Milepost (MP) 60, as the pipeline passes from the non-sensitive Gulf Coast Aquifer System to the sensitive Brazos River Alluvium.

7.3.2.3 Zone of Impact

The distance from the pipeline to a public water supply (PWS) well is a critical parameter in the determination of the potential for sensitive impacts. In addition, the potential for a release to reach the ground water table in any individual aquifer is related to the rate of ground water transport that can be realized within the aquifer. This rate of transport was used as a tool to delineate the distance away from the pipeline for which a PWS well, domestic well, or agricultural well would need to be considered as potentially impacted by a release.

Ground water movement in the Gulf Coast Aquifer, for example, is expected to take place on the order of feet per year, as discussed in Appendix 7A. Transmissivity in some of the alluvial aquifers crossed by the pipeline may be higher, and may be exacerbated by recharge to and from the associated rivers or streams. In the karstic Edwards Aquifer (BFZ), transmissivity rates of up to four miles per day have been documented based on dye tests (Hauwert et al., 1998). In the karst formations of the Edwards-Trinity aquifer, there are no comparable dye test data. Modeling was done in conjunction with this EA, and a velocity range of 58 to 1,234 feet per year was estimated. This same study concluded that locally, ground water flow rates could be much higher than the average due to fracturing or solutioning, and that it was reasonable to assume that ground water flows of several hundred feet per day could occur. In the Carrizo-Wilcox Aquifer, ground water flow rates ranging from 10 to 2,200 feet per year are anticipated as discussed in Appendix 7A.

Thus, along the pipeline, the level of understanding regarding contaminant transport velocity, and therefore a "zone of potential impact," varies. There are areas where the fate of contaminants reaching the ground water is either:

- Well-defined through study [the Edwards Aquifer (BFZ)];
- Predictable based on gradients within the aquifer and associated surface waters (alluvial aquifers);
- Difficult or impossible to exactly predict in the absence of specific dye tracer studies (Veni, 1999) (Edwards Trinity Aquifer); and
- Reasonably characterized using traditional ground water transport models (other non-karst aquifers).

The zone of potential impact for these aquifers was defined as follows. For non-karst, non-alluvial aquifers along the route, a distance of 2.5 miles is considered a very conservative (i.e., tends to overstate effects) zone of impact. For alluvial aquifers and in the Edwards Aquifer (BFZ), the zone of impact is directional based on river or known ground water flow patterns. Wells contained within the alluvium downstream of the alluvial crossing are considered to be potentially impacted by a release, while through the Edwards Aquifer (BFZ) any wells between the pipeline and Barton Springs or Cold Springs are considered to be in the zone of impact.

Along the Edwards-Trinity Aquifer, in the absence of delineated wellhead protection areas, a zone of impact 25 miles to either side of the pipeline was selected as a potential zone of impact. There are no data available to suggest that in the Edwards-Trinity formation, fracture or conduit flow of contaminants would occur over distances greater than 25 miles. Modeling of the Edwards-Trinity, in lieu of basic data on the parameters necessary to conduct such modeling, is not a helpful exercise—it would be possible to generate order-of-magnitude estimates for the velocities that contaminants could travel, but the absence of information on size, length, and tortuosity of transport pathways greatly limits the validity of any estimates.

There are important differences between the movement of ground water in the karst of the Edwards Aquifer (BFZ), and in the Edwards-Trinity aquifers. First, the Edwards Aquifer (BFZ) has large gradients, causing the high velocities seen in the formation. Second, the Edwards Aquifer (BFZ) has large flow systems, while the Edwards-Trinity is more susceptible to smaller, localized flow systems. Fractures in the Edwards Plateau are probably a result of regional uplift rather than to local faulting and folding, and caves, though extensive, are confined to small vertical intervals (Veni, 1994). Thus, the combination of flow rates and travel distances observed in the Edwards Aquifer (BFZ) are unlikely to exist at any specific location in the Edwards-Trinity formation.

In the absence of site-specific testing, it is impossible to rule out the potential for a concentrated plume of contaminants traveling this distance over a time that would preclude remediation. Twenty-five miles serve as a probabilistic tool to screen for those PWS.

7.3.3 Methodology

7.3.3.1 Drinking Water

Hydrogeologic sensitivity of the individual aquifer formations, and proximity of public water supply receptors in the vicinity of the System, are evaluated separately in Chapter 4 and then combined to form a single sensitivity score.

The Chapter 4 evaluation focuses on PWS wells—including municipally owned systems, municipal utility districts (MUDs), and water supply companies. Domestic wells were also considered when evaluating impacts to drinking water supplies in this section.

The zone of impact described above was used to count domestic wells that were more likely to be impacted by a release along the pipeline. Data were gathered from the Texas Natural Resources Information System (TNRIS) with the awareness that this database is incomplete. However, it is appropriate for use as an indicator of the density of domestic wells along the line, with the assumption that the actual well count may be two to four times higher[3]. No areas in which a release would only impact domestic wells were considered to be highly sensitive, because the overall challenges of replacing service to domestic well users would be less than replacing service to an entire PWS.

Maximum impacts to drinking water quality might occur where the geological sensitivity of the aquifer, aquifer transport characteristics, and proximity of PWS wells indicate it is possible for contaminants from a leak to travel the distance from the leak to the wellfield and cause drinking water MCLs to be exceeded.

The entire Edwards Aquifer (BFZ) through south Austin is an area subject to special consideration for potential impacts to ground water as a drinking water resource resulting from a

[3] Lower Colorado River Authority's (LCRA's) Scoping Input to EPA, Issue B2 comments that Texas Water Development Board (TWDB)/TNRCC records of well installations are incomplete. Two to four times is considered a conservative estimate.

release. Any release along this stretch of pipeline could result in potential contamination of drinking water wells between the pipeline and Town Lake.

Longhorn conducted an intensive geotechnical investigation of the pipeline crossing of the Edwards Aquifer (BFZ) (LBG-Guiton, 1998). The data generated by this investigation do not provide a useful tool for a more refined delineation of sensitivity across the zone, particularly with respect to the bands of hypersensitive Leached and Collapsed Member and Kirshberg Evaporate Member units of the zone. First, the investigative technique's ability to locate fractures or voids was limited, leaving open the possibility of existing narrow, barely detectable fractures that still provide ample conduit for contaminants to travel rapidly to the ground water table in the event of a release. Second, even in the absence of a localized recharge feature, the pooling or overland flow from a major release along this section, or even along the slightly less sensitive portions of the Edwards Aquifer (BFZ), could nonetheless, reach a recharge feature and result in significant contaminant entrance into the aquifer.

In addition to the stretch of sensitive and hypersensitive bands of the Edwards Aquifer (BFZ), portions of the pipeline crossing of the contributing zone for the aquifer have to be considered sensitive for potential impacts to the aquifer and to Barton Springs and Cold Springs. Crossings of Barton Creek and Long Branch in the contributing zone were therefore considered sensitive for significant impacts to these ground water dependent resources. Also, overland flow pathways were modeled to determine which points along the pipeline have the highest potential for contamination to Barton Creek and associated tributaries, in the event of a spill at a location other than the crossing. These points that would reach the crossing via overland are also considered sensitive.

Two additional segments of pipeline, both over the Edwards-Trinity Aquifer, are considered sensitive for drinking water. One stretch (MP 341 – MP 346) is potentially upgradient from public drinking water wells which supply the City of Eldorado less than 2.5 miles north of the pipeline, and karst features identified in the vicinity of the pipeline could provide a conduit to contamination of this portion of the Edwards-Trinity Aquifer that supplies the city. A second stretch (MP 423 – MP 428) is proximal to Upton County Water District wells within 2.5 miles of the pipeline and the City of Big Lake wells within 25 miles of the pipeline; also, this five-mile stretch lies in an area with identified karst features.

Two alluvial bands along the pipeline, and two additional locations over the Edwards-Trinity Aquifer, are slightly less sensitive for drinking water.

- The section of the pipeline (MP 163.48 – MP 164.91) that crosses the Onion Creek watershed in eastern Travis County, as public water supply wells for the City of Bastrop may draw from the Colorado River alluvium downstream of Onion Creek's confluence with the Colorado;
- The section of the pipeline (MP 492 – MP 495) that crosses the Cenozoic Pecos Alluvium downstream of the City of Pecos PWS wells, but upstream of the PWS wells for Grandfalls, some of which are in the alluvium band;
- The section of the pipeline (MP 356 – MP 361) that crosses the Edwards-Trinity Aquifer within 2.5 miles of an identified PWS, but not in the area of identified karst formations; and
- An extension of the section mentioned above proximal to Big Lake and Upton County wells, from MP 410 – MP 423.

Aside from these areas, the rest of the pipeline has a low proximal sensitivity to public drinking water supplies. An evaluation was made to determine the proximity and number of domestic wells along the pipeline. Domestic water supplies pumped from wells were categorized according to which aquifer the water is derived from. Aquifer segments were scored on the number of domestic wells listed per mile for each aquifer considered proximal to the pipeline.

Evaluating Gasoline versus Crude Oil

With respect to contamination of ground water resources, gasoline is considered to have higher impacts to drinking water supply than crude oil for the following reasons:

- Gasoline has a higher BTEX content than crude oil;
- Very low concentrations of MTBE can render a drinking water supply nonpotable; and
- The low viscosity of gasoline allows it to travel faster and farther in most aquifers.

Ignition Events

Ignition of a large volume leak would reduce in the amount of contaminant that would enter the aquifer formation from a given size leak, and therefore, events involving ignition would cause less ground water contamination than leaks not involving ignition.

7.3.3.2 Long-Term Water Quality

The parameter of long-term water quality represents an attempt to address the duration that contamination might persist. In some ways, this could be viewed as a variable affecting drinking water supplies. However, in this analysis, it was separated from drinking water impacts, so that drinking water impacts could be judged solely as a function of whether a release could contaminate a drinking water well.

The porosity of the medium will affect the flow of contamination, thereby determining the length of stay in the aquifer. Impact duration will depend on the lithology (characteristics) of the aquifer and its permeability factor. If the aquifer consists of clay, silt, or organic matter, the long-term water quality impact may be higher for a small, long-term leak than for a large leak. This is because it is more probable that small leaks could continue for a considerable period of time, and therefore elude rapid response and remediation activities (such as soil excavation, and pump and treat) that would be applied to larger, more quickly detected events.

Long-term impacts in karst aquifers is a more complicated phenomenon. Because of the existence of localized recharge features, there is the potential for rapid movement of contaminants from a release close to the surface of the ground water table. However, since only a portion of a large leak or spill may find this recharge feature, some volume of a large release may instead simply leach into the topsoil and percolate into the aquifer at a slower velocity, dependent on rainfall events. Thus, contaminants may still enter the ground water table long after the original introduction of contaminants, and thus result in long-term water quality problems due to the nature of the input to the hydrologic system.

Another phenomenon that could cause long-term water problems due to contamination of karst formations is the “bathtub ring” effect (Veni, 1999), whereby contaminants in ground water may attach on the walls of caves, or be trapped in pores or on ledges during high flow conditions and remain when the water level decreases. When another high flow condition raises the water level, contaminants from a release of crude oil or gasoline can re-enter the ground water and cause a degradation in water quality. Because of this effect, it is possible for a well or spring to no longer appear contaminated, then begin discharging contaminated water following a major rainfall event.

However, it does seem likely that under consistent flow conditions, the increased rate of transport within a karst aquifer will result in a complete flushing of contaminants. Long-term aquifer damages have not been documented due to the spills of crude oil from EPC and adjoining lines over the Edwards Aquifer (BFZ), despite short-term detection of volatiles in adjacent caves following these events. As described earlier, this area is subject to higher ground water gradients and more regular precipitation than karst regions farther west.

Thus, karst terrain is very sensitive to long-term impacts to ground water quality from large leaks, and potentially less sensitive to small persistent leaks. In karst, a larger leak is judged to have potentially serious long-term consequences. A larger volume of discharge is more likely to result in a concentration gradient that could cause deeper penetration of BTEX and MTBE into the aquifer, slowing the rate of eventual flushing from the aquifer. But under both scenarios, contamination is likely to remain in the aquifer for a considerable period of time, and be resistant to treatment or removal by mechanical means.

For aquifers consisting of sand and/or silt, which are more permeable than clay, and aquifers defined as gravel or a low permeability limestone, a balance between transport and sorbability must be considered. Because the formations have lower organic content, contaminants will more readily pass from the aquifer to discharge features, or to water supply, irrigation, or remediation wells. However, the higher velocities in these aquifers will allow contaminant plumes to travel farther away from the source, complicating remediation activities.

The long-term impacts of crude oil will likely be higher than for gasoline, because of its high viscosity and surface tension when compared to gasoline, and because of crude oil's lower solubility combined with higher density and lower volatility. This is particularly evident in non-karst formations, because gasoline will move rapidly through the aquifer and dissolve more readily from an alluvial aquifer into the associated river or stream.

In a karst formation, crude oil will move at a slower rate through the formation, and the surface tension of crude oil will cause it to adhere to conduit walls during low flow conditions, rather than spreading across and dissolving into the water column. Turbulence in the water passing through conduits will also have an impact on entrainment of gasoline or crude oil into the water phase.

7.3.3.3 Agricultural Uses

Evaluation of impacts to agricultural uses of ground water focused on potential impacts to irrigation wells. Irrigation wells were identified along the pipeline using the same distance criteria described above for domestic drinking water wells.

MTBE should not significantly impact the use of ground water for irrigation purposes. However, it is not known whether the higher BTEX concentration of gasoline, or the viscosity and additional contaminants (e.g., metals) in crude oil, would indicate whether gasoline or crude oil would have relatively greater impacts to agricultural uses. As with drinking water impacts, a release involving ignition is anticipated to reduce the overall volume of contaminant that might enter the aquifer. Igniting gasoline and crude oil spills can pose a threat to human life and property, but reduce water contamination.

7.3.3.4 Recreational Uses

Recreational uses of ground water resources were evaluated based on the potential for and identification of caverns within each particular aquifer. A determination of sensitivity depended on whether a given aquifer was identified as karst and on documented cave formation.

Seven aquifers along the pipeline were identified as containing caves that would make them susceptible to contamination—the Edwards Aquifer (BFZ), the Trinity Aquifer, the Ellenburger-San Saba Aquifer, the Marble Falls Aquifer, the Edwards-Trinity Aquifer, the Capitan Reef Complex Aquifer, and the Rustler Aquifer.

Known karst areas with no documentation of caverns are less sensitive for recreational impacts than areas with documentation of caverns. Maximum sensitivity is defined as places along the pipeline where a release could cause permanent damage to a public or commercial cave that the public visits. There were no places along the line that fit this description.

Normal operation of the pipeline is not expected to result in any damage to a cave. While it is possible that damage could occur from the weight of liquid passing through the line over a collapsible formation, this has not been a problem during the several decades the EPC line operated. Therefore, no impacts were considered for normal operation. While pipeline construction activities can damage caves, current plans do not call for any activities that could cause cave damage.

7.3.4 Potential Impacts Analysis

Normal pipeline operations and construction activities present little or no impacts to ground water resources. There may be some impacts due to silting from construction or maintenance activities, but these are considered minor.

There is a potential for damage to ground water from a large release of crude oil or gasoline along the much of the pipeline. A limited portion of the pipeline is considered sensitive for impacts to drinking water resources. The potential impacts of a large release to other portions of the pipeline are considered to be minor. Impacts from a release of gasoline to agricultural use of ground water, or to recreational caves, are expected to be minor. A release of crude oil could result in greater impacts to the use of ground water for agricultural purposes.

There are a number of aquifer features where an event involving a large release of crude oil or gasoline could potentially cause major negative impacts to drinking water supplies. Impacts could include human health risks posed by benzene, toluene, and other organic compounds present in gasoline, and, to a lesser extent, crude oil. Additionally, exceedance of the Texas MCLs for any of these constituents would cause problems for communities relying on the contaminated portion of an aquifer for drinking water supply. The presence of MTBE in a release of gasoline could also cause nuisance problems which render ground water unpotable.

Areas along the pipeline deemed sensitive for ground water contamination are included in Table 7-1. Table 7-2 provides a sub-listing, including areas judged to be hypersensitive.

7.3.5 Mitigation Measures

Any measures that reduce the probability or potential volume of a gasoline release to sensitive aquifers would have a positive impact on reducing risk to these resources posed by the pipeline. In particular, capabilities for enhanced detection and location of smaller leaks is more critical in protecting ground water supplies, as a small leak can release a considerable volume of product over time if undetected.

In addition, enhanced emergency response could provide an additional factor of safety in the event of a release, in order to reduce the amount of gasoline from a release which may reach a downstream or underlying sensitive aquifer. For completeness, emergency response procedures may need to include contingency planning for provision of drinking waters to municipalities whose drinking water wells could be rendered non-potable from leak.

7.4 AQUATIC BIOLOGY

7.4.1 Introduction

The System crosses numerous rivers and streams that provide habitat for fish and other aquatic species. An accidental release of product that would enter a water body is likely to affect aquatic organisms at the release site (point of entry) and downstream. The extent of such impacts would be contingent upon the amount of product and temporal and spatial factors that could range from short-term and confined to a limited reach of the river or stream, to long-term and extensive that could reach several miles downstream. Common fish species that could be affected are listed for major rivers and streams in Chapter 4.

Releases to karst areas that are crossed by the existing pipeline system could impact troglodytic (cave-dwelling), and aquifer-dependent species. Potential impacts associated with the planned new pump stations also are addressed. Analyses of karst invertebrates focused on federally listed species in Travis County. None are within proximity to Longhorn pipeline and none would be directly affected by a release of product. Determination of sensitivity is based on potential for known or suspected habitat loss from a release and potential takings of individual species members. Results of impact ranking are provided in Table 7-4.

7.4.2 Potential Impacts

7.4.2.1 Potential Impacts from a Release to Major Rivers

A large release of gasoline to Hunting Bayou, Greens Bayou, White Oak Bayou, Halls Bayou, Cypress Creek, Brazos River, Colorado River, Pedernales River, Llano River, Pecos River, or their tributaries would likely result in a loss of fish and aquatic invertebrates immediately downstream. Aquatic species that could be affected by a large release include: Largemouth Bass, Guadalupe Bass, Channel Catfish, Green Sunfish, and Longear Sunfish. Loss of fish within affected river reaches would result from toxicity. If the product were ignited, heat and oxygen depletion within the water column also could contribute to mortality rates. Although the extent of such impacts would be highly variable and dependent upon flow conditions at the time, quantity of product lost, and other factors, it is possible that toxicity levels would be sufficiently high to affect population numbers a significant distance from the point of the discharge.

A release to a major river would not directly affect federally listed threatened or endangered fish species; however, under certain circumstances, product could reach the Devil's River Minnow population, which is a candidate species for listing as endangered. Although habitat for the species is not in the vicinity of the System, it is downstream from several rivers, streams, and arroyos that are crossed by the pipeline. An accidental release of product is highly unlikely; however, if one were to occur during extreme rainfall conditions, some product might reach the species. Conditions in which the Devil's River Minnow could be affected would be a large release of product during a rainfall event sufficient to transport product more than 100 miles downstream.

Based on presently known information regarding the range and distribution of the Pecos Pupfish, the species is currently found up-gradient within off-channel waters within the Pecos River watershed. Although the species was once present within the river downstream from the pipeline crossing, none are known to be within the area that could be affected in the unlikely event of an accidental product release.

7.4.2.2 Potential Impacts from Construction of Additional Pump Stations and Odessa Lateral

Ten pump stations are planned for construction and three existing stations will be modified to increase pipeline throughput from 72,000 bbl per day (bpd) to an ultimate capacity of 225,000 bpd. All new stations would be constructed within an area that will be fenced, and gravel or caliche will be used to surface the work area. As much as five acres could be disturbed during site construction and, under some conditions, additional areas could be disturbed for site access. Specific locations of new pump stations are not known at the present time; however, their relationship to natural regions within the state as discussed in Chapter 4 were identified for analysis purposes. Planned new stations, milepost locations, county locations, and natural region are as follows:

Planned New Station Locations

Station	Milepost	County	Natural Region
Buckhorn*	67.5 - 77.5	Austin	Gulf Coast Prairies and Marshes
Orotaga*	203.8 - 213.8	Blanco	Llano Uplift
Llano*	265.0 - 275.0	Mason	Llano Uplift
Cartman*	334.0 - 344.0	Schleicher	Edwards Plateau
Olson*	410.0 - 420.0	Reagan	Edwards Plateau
Big Lake	373.5	Crockett	Edwards Plateau
Pecos*	516.2 - 526.2	Ward	Trans-Pecos
Utica*	543.6 - 553.6	Reeves	Trans-Pecos
Cottonwood	576.3	Culberson	Trans-Pecos
Harris*	642.6 - 652.6	Hudspeth	Trans-Pecos

*Specific location undetermined

A review of river and stream crossings indicates that the Buckhorn Station would be no closer than 3.5 miles to the Brazos River, the Llano Station would be no closer than 1.5 miles to the Llano River, and the Pecos Station would be no closer than 0.6 miles to the Pecos River, all of which are classified as major rivers. Based on minimum distances from major rivers, it is unlikely that fisheries resources would be impacted from station construction activities. All other station locations are near small creeks and drainages that are unlikely to have fish populations that could be impacted from construction activities.

No species of concern were identified within the waterways crossed by the proposed Odessa Lateral.

7.4.2.3 Potential Impacts to Troglodytic and Aquifer-Dependent Species

The U.S. Fish and Wildlife Service (FWS) (1995a) and Texas Parks and Wildlife Department (TPWD) currently list the Bee Creek Cave Harvestman, Bone Cave Harvestman, Kretschmarr Cave Mold Beetle, Tooth Cave Ground Beetle, Tooth Cave Pseudoscorpion, and Tooth Cave Spider as endangered species within Travis County. Although the distribution of these species is generally limited to the Jollyville Plateau and other northern Travis County areas, they are indicative of species that are unique to karst habitat. All known populations of federally listed karst formation invertebrates in Travis County are located north of the System and would not be affected by an accidental release to the Edwards Aquifer (BFZ).Additionally, the FWS (1995b) indicates an additional 38 rare endemic arthropods to be present in karst formations that were evaluated as part of the Balcones Canyonlands Conservation Plan.

It is assumed that a major release of product to the hypersensitive karst formations crossed by the existing pipeline would impact karst invertebrates. Areas most susceptible to adverse impacts of an instantaneous release are downgradient from MP 173.5 through MP 175.0. The pipeline also crosses 8.2 miles of less sensitive karst formation west of MP 175 that contributes to the Edwards Aquifer (BFZ) and Barton Springs. Other known karst areas scattered throughout much of the Edwards Plateau west of Austin are less defined and understood than those in Travis County. A review of recharge zone information compiled by Horizon Environmental (1999) indicates that approximately 2.6 miles of the pipeline crosses highly sensitive areas of the aquifer.

The Barton Springs Salamander is particularly susceptible to acute and/or chronic ground water contamination. Since the species is fully aquatic, there is no possibility for escape from contamination or other threats to its habitat. Crustaceans, particularly amphipods, on which the salamander feeds, are especially sensitive to water pollution. The species also is particularly susceptible to contaminants due to their semipermeable skin, the development of their eggs and larvae in water, and their position on the food web (Federal Register, 1997).

Although a release of product within hypersensitive or sensitive karst formation areas of Travis County is unlikely, a large spill could adversely impact the Barton Springs Salamander and may result in the loss of the species.

The City of Austin and the FWS drafted a Habitat Conservation Plan (HCP) to protect the Barton Springs Salamander. Although the HCP was drafted to allow incidental takings of the species that would likely occur as a result of maintenance, cleaning, and recreational use of the springs (Eliza, Old Mill, Upper Barton Springs, and Barton Springs Pool), and it includes requirements to protect the species in the event of a instantaneous spill of toxic substances. Specifically, Austin is required to "…develop a instantaneous spill response plan…." to address spill prevention, containment, remediation, and salamander rescue. The HCP also requires Austin to maintain a viable captive breeding population to ensure survival of the species in the event of a instantaneous spill. Such precautions would be in place during the operation of the pipeline; they would not reduce the severity of impacts to the habitat or the species should a large release of product enter the springs.

7.4.3 Methodology

Criteria were developed to address potential impacts that would be associated with a product release due to a pipeline rupture or leak. Impacts associated with a large instantaneous release of product include losses due to fire, toxicity (contamination), and effects of contaminant cleanup and remediation. Impacts to species and habitat that would be associated with a product release are summarized below.

- Large instantaneous spills may create immediate toxic situations, causing the death of the species of interest;
- Fires from spills may destroy federally listed threatened or endangered aquatic species;
- Small persistent leaks could be assimilated by the species of interest on a short-term basis, but may damage reproductive organs and affect species growth in long-term scenarios;
- Small persistent leaks may alter habitat over the long term by increasing toxicity and changing vegetation in the area of interest; and
- Sediment and soil transport from areas under construction at pump stations may degrade riverine habitat.

7.4.4 Potential Impacts Analysis

Normal pipeline operations will pose minimal, if any, adverse impacts to aquatic biology. There is some potential for impacts to aquatic populations in the improbable event of a release at any point where the pipeline crosses a stream or river, or where a release from the pipeline could drain toward a surface water body. These locations are discussed further in Section 7.6. It is not anticipated that long-term major impacts to aquatic populations would result. Impacts could result to the Pecos Pupfish from a release to the Pecos River, but as the chances of a major release at that point in the pipeline are less than the probability of impacts along the line as a whole (since the Pecos River crossing is part of the newly constructed pipeline), the overall risk and impact to the Pecos Pupfish is considered minor.

Similarly, there is a possibility of some damages to the Devil's River Minnow, which is a candidate for listing as an endangered species, but the distance downstream to the Minnow habitat makes it very unlikely that during the pipeline service life a release would have an adverse impact on the species. These locations are discussed further in Section 7.6.

Crossings of the Devil's River and tributaries are along the original EPC pipeline, and would be subject to crude oil transport if gasoline transport does not take place. It is likely that a release of crude oil would have impacts equal to or greater than gasoline impacts to Devil's River Minnow habitat.

If a release were to occur over the BFZ, there is the possibility for adverse impact to the Barton Springs Salamander. It is possible that a slightly higher potential exists for gasoline to reach the aquifer and be transported to Barton Springs, where impacts to the Salamander populations would occur. However, it is also possible that potential impacts from a release of crude oil to Barton Springs would be higher than potential impacts from a release of gasoline product. The possibility is a combination of factors discussed in Section 7.3, including the potential for the contents of a gasoline or crude oil release to pool on the surface versus transport directly into the aquifer. There is currently no way to quantitatively differentiate between the impacts to the Barton Springs Salamander from a release of gasoline at worst-case locations within the Edwards Aquifer (BFZ) recharge zone or contributing zone, and from a release of crude oil at an analogous location.

7.4.5 Mitigation Measures

The one identified major impact to threatened and endangered species lies in the potential for a release of gasoline or crude oil to contaminate Barton Springs Pool where it could damage

Barton Springs Salamander populations. Therefore, mitigation measures should be implemented to mitigate, in part, the risk to the Salamander population through reducing the chance and potential volume of a release over the Edwards Aquifer (BFZ) recharge zone and in places in the recharge zone. Leak detection enhancement measures could also prevent possible damages to the Salamander population, as well as incorporation of any other means of reducing emergency response times.

At a minimum, Longhorn mitigation measures should ensure that emergency response plans are consistent with the City of Austin's Barton Springs Oil Spill Contingency Plan and the FWS Barton Springs Salamander Recovery Plan.

7.5 TERRESTRIAL BIOLOGY

7.5.1 Introduction

Periodic brush removal would require the use of heavy machinery which would cause disruption to, and displacement of, local wildlife. The extent of such impacts would include minor displacement of mammals, birds, and reptiles within, and adjacent to, the right-of-way (ROW) as a result of human activity and noise. Actual loss of habitat that would be attributed to ROW maintenance is not expected because the alignment from Houston to Crane has been maintained and relatively clear of trees and brush as part of previous pipeline operations. The alignment west of Crane and Crane to Odessa has been recently constructed; consequently, habitat that once was present along the alignment has been removed.

The focus of this section is on non-aquatic federally listed threatened or endangered species and species that are candidates for listing as either threatened or endangered that could be affected by the project. Analyses also addressed potential impacts to dominant species, other species of concern, and important habitat along the existing pipeline corridor, along additional line to be constructed in El Paso and along the Crane lateral, and at future pump station locations. These species are identified in Table 7-5.

7.5.2 Potential Impacts

Criteria were developed to address potential impacts associated with a instantaneous release of product in the event of a pipeline rupture. Impacts associated with a instantaneous release of product include losses due to fire, toxicity (contamination), and effects of contaminant cleanup and remediation. Impacts to species and habitat that could be associated with a release of product are summarized below:

Species and Habitat

- Large instantaneous spills could immediately create toxic situations resulting in adverse impacts on species of interest.
- Fires from spills may destroy federally listed threatened or endangered terrestrial and vegetation species and habitat.
- Small persistent leaks could be assimilated by the species of interest on a short-term basis, but may damage reproductive organs and affect species growth in long-term scenarios. Fires from spills may adversely impact federally listed threatened or endangered species and habitat.
- Bioaccumulation of spill constituents in species lower on the food chain may affect predator populations (such as the Bald Eagle).
- Construction activities associated with pump stations and storage facilities may impact the species of interest, causing migration to other, less-suitable habitat.
- Construction activities may necessitate the removal of some threatened or endangered vegetation species.

7.5.2.1 Potential Impacts from Routine Operation and Maintenance

The Black-capped Vireo and the Golden-cheeked Warbler have been reported from several counties west of Austin. Neither species would nest or forage within the existing pipeline corridor, which has no suitable habitat. Habitat requirements for the vireo includes dense shrubs that provide suitable nesting sites that are relatively close to the ground. The Golden-cheeked Warbler requires mature ashe juniper and hardwoods for nesting and foraging. Although land management practices, including brush clearing, have reduced the availability of habitat for both species throughout their ranges, it is likely that they are present to some portions of the pipeline corridor. Field investigations conducted by Horizon Environmental (1999) indicate that Black-capped Vireos and Golden-cheeked Warblers were present along 7.4 and 16.6 miles of the pipeline, respectively, during the spring to early summer of 1999.

The range and distribution of the Southwestern Willow Flycatcher include Hudspeth, Culberson, and El Paso counties, which are west of the Pecos River. Habitat requirements include dense riparian willow, cottonwood, tamarisk, baccharis, and other woody species that are relatively common along stream banks and arroyos of the region. Although populations may be present at scattered locations near the existing pipeline ROW, none would be within the corridor due to routine brush removal.

Adverse impacts to the Black-capped Vireo, Golden-cheeked Warbler, and Southwestern Willow Flycatcher population are not expected during normal pipeline operations; however, corridor maintenance, including routine brush removal, could temporarily disturb some nesting birds adjacent to the pipeline corridor, if such activities were undertaken during nesting season. Such impacts could be eliminated by scheduling routine maintenance of the pipeline corridor to the fall and winter when the birds are not present.

Results of field investigations conducted by Horizon Environmental (1999) indicate that approximately 0.8 pipeline miles cross potential Houston toad habitat. Although the pipeline crosses federally designated critical habitat for the species, habitat within the area is fragmented and of marginal quality. Furthermore, no Houston toad populations are known to be present within the area that could be impacted by pipeline ROW maintenance or as a result of an accidental release of product or associated cleanup activities (Leisure, 1999).

TPWD and FWS data indicate that six federally listed threatened or endangered plant species and two plant species that are candidates for listing as either threatened or endangered are known to occur within counties crossed by the existing pipeline. Texas prairie dawn is known to occur in Harris County and may be present along segments of the pipeline corridor where there is undeveloped land. Habitat requirements for the species include sparsely vegetated areas with fine sandy soils, in poorly drained soils, and around the base of mima mounds and similar features. Field investigations conducted by Horizon Environmental during 1999 indicate that potential habitat is present along approximately 9.6 miles of the pipeline. Areas most likely to support the species are in western Harris County and eastern Waller County.

Navasota Ladies'-tresses is endemic to moist sandy soils of southeaster Texas. The species is most often found within small openings in post oak savannah. The species typically is associated with erosional remnants between rills in slightly to moderately eroded areas along minor intermittent tributaries of the Navasota, Trinity, and Brazos rivers (Horizon, 1999). Associated species include post oak, blackjack oak, yaupon, slender bigelowia (*Bigelowia nuttallii*) and *Spiranthes cernua* (Horizon, 1999). According to Horizon Environmental, as shown in Appendix 7B, a small population is known to be within 6 miles of the pipeline and 2 miles north of the city of Fayette.

Tobusch fishhook cactus is known to occur on limestone gravels of stream terraces, limestone ledges, and ridges and within oak juniper woodlands in Kimble County. Texas snowbells is a rare endemic shrub that also is found on limestone bluffs and cliff faces along rivers, streams, and dry creek beds in Kimble County. Although field investigations were not conducted to determine the presence or absence of either species, it is possible that populations are present within undisturbed areas adjacent to the pipeline ROW. Periodic maintenance of ROW, which includes brush clearing, would reduce the potential for the species to be present within the ROW, and it is unlikely that any populations would be present in the area. Consequently, potential impacts associated with normal pipeline operations or ROW maintenance are unlikely.

The puzzle sunflower is a rare endemic species that has been proposed for listing as threatened. Habitat requirements for the species is limited to moist heavy alkaline/saline calcareous silty clays and looms in and around cienagas (desert springs) in Reeves County. Potential impacts to the puzzle sunflower are not anticipated due to the absence of springs along the System ROW.

Guadalupe fescue and gypsum wild-buckwheat are rare endemics that have been found in Culberson County. Populations of gypsum wild-buckwheat are more likely to be present in the vicinity of the pipeline than that of the Guadalupe fescue. Those areas that potentially could support buckwheat populations include lowlands east of the Delaware Mountains. Guadalupe fescue is endemic to woodlands on mesic slopes and in creek bottoms at elevations above 6,000 feet, which are not present along the alignment crossed by the pipeline. Sneed pincushion cactus is endemic to limestone ledges of the Chihuahuan Desert at elevations from 3,900 to 7,000 ft. and has been found in El Paso County. The pipeline corridor is below 3,900 ft. in El Paso County, and it is unlikely that this species would be present. None of the species would be affected by normal pipeline operations and maintenance.

7.5.2.2 Potential Impacts From Construction and Operation of New Pump Stations

Ten new pump stations are planned for construction to increase pipeline throughput from 72,000 bpd to 225,000 bpd. Potential impacts associated with new station construction would include disturbance to approximately five acres at the station location as well as along new roads, should construction be required to provide vehicular access. Two station locations have been identified; specific locations of eight of the ten stations are unknown, but provided as 10-mile-long segments along the existing pipeline. Local wildlife in the area would be impacted as a result of facilities development and increased human activity and noise. The extent of the impacts would cause the permanent loss of at least one acre at each pump station location as well as long-term changes in habitat within adjacent areas that would be disturbed during construction. Short-term impacts to local wildlife would result from increased human activity and noise during construction which would result in the temporary displacement of some species.

Impact analyses associated with proposed station locations were conducted based on available literature. Field investigations would be required to acquire site-specific information.

The Buckhorn Station would be located in Austin County, which is in the Gulf Coast Prairies and Marshes Natural Region. Federally listed threatened and endangered species within the county are limited to Attwater's Greater Prairie Chicken and the Bald Eagle. However, it is unlikely that either species would be affected by the project because habitat that would support either species is not within the area crossed by the pipeline.

The Orotaga and Llano stations would be constructed in the Llano Uplift Natural Region, and it is possible that potential Golden-cheeked Warbler and/or Black-capped Vireo habitat could be affected by site development. The area is in an upland setting and absent of large trees that are required for Bald Eagle nesting. Therefore, potential impacts to the species are unlikely.

The Cartman, Olson, and Big Lake stations would be located on the Edwards Plateau Natural Region in Schleicher, Reagan, and Crockett counties, respectively. The Black-capped Vireo is the only federally listed species known to occur in the counties, and potentially the only federally listed species that could be affected by site development.

Four proposed new pump stations (Pecos, Utica, Cottonwood, and Harris) would be located within the Trans-Pecos Natural Region in Ward, Reeves, Culberson, and Hudspeth counties, respectively. Federally listed threatened and endangered species that have been reported to occur in the counties are: the puzzle sunflower (Reeves County); the Southwestern Willow Flycatcher (Culberson and Hudspeth counties); and Guadalupe fescue and gypsum wild-buckwheat (Culberson County).

The puzzle sunflower is found in areas in and around cienagas (desert springs) which would be avoided during construction. Field investigations would be required to determine the presence or absence of the species, but impact to the species is not expected as a result of construction of the Pecos station. None of the stations would be developed within drainage ways or arroyos. Potential impacts to the southwestern willow flycatcher or its habitat are highly unlikely. A site for the Cottonwood Station (Culberson County) has been identified at MP 576.3, along the east side of the Delaware Mountains at an elevation of approximately 3,850 feet; therefore, Guadalupe fescue or gypsum wild-buckwheat populations are unlikely to be present.

7.5.2.3 Potential Impacts From Accidental Release of Product

An instantaneous large release of product within areas occupied by the Houston toad could adversely impact on the species. The pipeline crosses Buescher State Park and is part of the federally designated critical habitat for the species, according to information provided by the superintendent for Buescher and Bastrop State Parks. Habitat within the park is limited to isolated pockets of marginal quality (Leisure, 1999).

Suitable habitat and known occurrence of the species is predominantly in unaffected Bastrop State Park and lands to the north. Secondary effects of a major release could occur in association with cleanup activities as a result of soil compaction, removal of trees and brush, and loss of the limited amount of habitat that is presently in the park.

It is also unlikely that an instantaneous release of product would affect Attwater's Prairie Chicken populations, because of the limited amount of potential habitat along the pipeline and because there are no known populations of the species along the pipeline ROW. The prairie chicken is a ground-nesting species that requires relatively undisturbed short to tall-grass prairie with little-to-no woody cover. Known populations of the species are more than 20 miles south of the pipeline corridor, in the Attwater's Prairie Chicken National Wildlife refuge, and there appears to be no suitable habitat for the species near the pipeline.

The Bald Eagle is most often found in mature bottomland forests where suitable nesting sites are available in tall loblolly pine, bald cypress, oaks, cottonwood, and sycamores. A instantaneous release of product to streams and rivers that flow to area impoundments could have an adverse effect on bald eagles that use such areas for feeding. Ingestion of contaminated fish, or the loss of fisheries resources, could result in the loss of some birds or changes in hunting (fishing) locations. Other adverse impacts to the species (and potentially other species) include bioaccumulation of hydrocarbons within the food chain. Although toxicological analyses would be required to determine sub-lethal levels and adverse health effects, it is likely that reproductive success of some birds would be adversely impacted.

The Interior Least Tern is a migratory species with a current summer distribution along the Red River from Louisiana to the panhandle, along the Canadian River (in the panhandle), the upper Trinity River, and several waterways within central Texas. Winter distribution is limited to the Texas coast. Habitat requirements for the species are primarily based on the presence of bare or nearly bare ground and alluvial islands for nesting, availability of food (primarily small fish), and favorable water levels during the nesting season. Preferred nesting sites are salt flats along lake shorelines, and broad sandbars, and barren shores within wide, unobstructed river channels. In the unlikely event of a large spill that would release product to the mainstream or major tributaries of the Brazos, Colorado, Llano, or James rivers, nesting terns may be adversely affected.

An accidental product release within the Golden-cheeked Warbler and Black-capped Vireo habitat could have an adverse impact on nesting birds if the event were to occur during the spring or early-summer should a leak have sufficient volume to reach down-gradient occupied habitat. The event and related cleanup activities also would result in the loss of potential habitat. Loss of individual birds could also occur in this case. A release of product in the Trans-Pecos natural area could similarly affect the Southwestern Willow Flycatcher, particularly if such an event were to result in flow to arroyos or similar drainages.

Potential impacts to listed plant species range from temporary loss of some populations to the permanent or long-term (i.e., several decades) loss of habitat. The effects of spill cleanup would include soil removal, compaction, and other disturbances. Species most susceptible to impacts from an accidental release of product are Navasota Ladies'-tresses, tobusch fishhook cactus, gypsum wild-buckwheat, puzzle sunflower, Texas prairie-dawn, and Texas snowbells.

Regardless of potential impacts to threatened or endangered species, a large release of product could result in the loss of localized habitat that is common within ephemeral drainages and arroyos. Loss of such habitat would have secondary impacts to a wide variety of avian and mammalian species.

7.5.3 Potential Impacts Analysis

Minor and infrequent impacts will occur to terrestrial species, including endangered and threatened, during normal pipeline ROW maintenance. These might include temporary seasonal disturbance of nesting bird habitat, and prevention of species from maturing within the ROW itself. These impacts would be equivalent whether gasoline or crude oil is transported in the pipeline.

Greater overall impacts to species could result if a major release occurs along the pipeline, due to disruption of habitat from soil and water contamination, and contamination due to subsequent cleanup activities. Also, these impacts would be equivalent whether crude oil or gasoline was released.

To eliminate or reduce the potential for adverse impacts due to construction of planned pumping stations, consultation with the FWS and the TDPW should take place prior to siting and construction of stations.

No major impacts are projected to sensitive terrestrial species along the pipeline right-of-way due to normal operations.

7.5.4 Mitigation Measures

To eliminate or reduce the potential for adverse impacts due to construction of planned pumping stations, consultation with the U.S. Fish & Wildlife Service (FWS) and the Texas Department of Parks & Wildlife (TDPW) should take place prior to siting and construction of stations. The implementation by Longhorn of risk reduction, enhanced leak detection, and emergency response measures undertaken for prevention of large releases along the line, will reduce the risk of potential impacts to terrestrial species.

7.6 IMPACTS TO SURFACE WATER

7.6.1 Introduction

The System crosses three major river basins in Texas—Brazos, Colorado, and Rio Grande as well as the drainage to the West Texas Salt Basin. In addition, the pipeline crosses 12 separate tributary watersheds of the Colorado, and three of the Rio Grande. Of the 288 streamlines (any creek, stream, or identifiable channel) crossed by the pipeline, five rivers are crossed (Brazos, Colorado, Pedernales, Llano, and Pecos), along with four tributaries having basins exceeding 200 square miles upstream of the pipeline crossing [James River (Llano), Onion Creek (Llano), Cottonwood Creek (Upper Pecos), and Antelope Gulch (drains to West Texas Salt Basin)]. A description of the major river and stream crossings, including description of streamflow regime, downstream water quality, and downstream water rights for the crossings, is provided in Chapter 4.

7.6.2 Potential Impacts

7.6.2.1 Quantification of Risks

This section deals with the impacts to surface water that would result from a release. Ongoing, routine operation of the pipeline is not expected to result in any surface water impacts.

As a conservative estimate, a 0.4-mile stretch of pipeline over each crossing was assumed to represent the area where a release would immediately impact the water body crossed. For any 0.4-mile stretch of pipeline, based on historical statistics from the EPC line, there exists a 1 in 1,800 chance of a large 5,000 gallon release during the 50-year life of the pipeline, or a 1 in 19,000 chance in any year.

In actuality, the potential for a release causing impacts to surface water bodies may be greater, due to the potential for overland flows which can flow for more than 0.2 miles downgradient to reach a river or stream. These overland flows can encounter competing mechanisms, such as vegetative cover and soil adsorption processes, which limit the volume which might actually reach the surface water body.

A large release, if not properly remediated, could cause low-level, long-term water quality problems due to contaminants trapped in surface soils slowly leaching to surface waters. As discussed in Appendix 7C, a 1.1 million- gallon crude oil spill on the Crane-to-Houston EPC pipeline in Kimble County apparently was not properly remediated. This incident, the largest spill on the EPC pipeline, illustrates (1) the secondary impacts that can occur under improper remediation, and (2) the persistence of crude oil as a soil contaminant.

7.6.2.2 Zone of Impact

As part of this EA, the consulting firm RJ Brandes conducted stream flow modeling for a number of rivers and streams crossed by the pipeline in the Lower Colorado River Basin. This study is contained in Appendix 7D. The intent of this modeling was two-fold:

- To determine the distance downstream from a release at which benzene and MTBE could exceed threshold criteria for drinking water quality (the Texas MCL of 5 ppb for benzene, and the EPA advisory level of 20 ppb for MTBE), under different leak volume and stream flow conditions; and
- To determine the duration for which a sensitive surface water intake could be exposed to a contaminant level in excess of the threshold criteria for drinking water quality as the contaminants flow downstream.

The results of this modeling showed that for the major crossings modeled, it is possible under certain flow conditions for the gasoline released during an instantaneous leak at the crossing (probability of release reaching the stream = 1) to cause a plume with contaminant concentrations in excess of threshold criteria to travel the entire distance to the Texas Gulf Coast.

However, by the time the contaminant reached the coast, the dilution and volatilization effects would be such that the contaminant would be little threat to the estuarine environment.

Adverse impacts to drinking water were based on the potential for contaminant concentrations in excess of threshold criteria reaching drinking water supplies, and on the duration for which a release may render a drinking water supply not potable.

Surface water contamination of drinking water intakes on the Brazos, and below Longhorn Dam in Austin, are likely to be short-term in duration. While stream modeling performed for this EA has indicated that a contaminant plume containing benzene concentrations of greater than 5 ppb would travel over a hundred miles downstream under certain flow conditions, this plume would travel past the affected water intakes in a time span between 10 and 20 hours in duration. Since a large-volume leak that could generate these concentrations in a plume and be quickly detected, there would be time for downstream water supply systems to prepare for the spill. Since the impact to these systems is short-term, this is not considered major.

The Highland Lakes could be impacted by a large-volume leak upstream, resulting in a period of contaminated excess of the MCLs. This would involve a large volume traveling from a crossing in the Barton Creek, Pedernales, Sandy Creek, or Llano River watersheds, causing Town Lake, Lake Austin, Lake Travis, or Lake LBJ to exceed threshold drinking water criteria. It is unlikely that the benzene criteria will be exceeded for any significant amount of time, because the travel distances involved and the large surface area of the lakes would provide ample time for volatilization to reduce benzene concentration below the 5 ppb level. However, the high solubility of MTBE could cause drinking water problems for a period of time. For example, a release of 5,000 bbl of 15 percent MTBE product proceeding unimpeded to Lake LBJ could cause an immediate concentration of 700 ppb MTBE in Lake LBJ, or 83 ppb in Lake Travis, assuming instantaneous entry of all contaminant into the lake and complete mixing[4]. If MTBE concentrations in the Highland Lakes reached these levels, it could take a considerable amount of time before the affected lake, and the water in the lakes and in the Colorado River downstream of the affected lake, reached an MTBE concentration less than the 20 ppb EPA advisory level.

MTBE phaseout has been announced by EPA. This phaseout will reduce the amount of MTBE which could reach drinking water supplies in the event of a release, and thus reduce the magnitude of impacts to drinking water supplies from a release.

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[4] Concentration based on a 138,500 acre-foot volume of Lake LBJ, and on a 1,170,752 acre-foot volume of Lake Travis, from LCRA website.

7.6.2.3 Overland Flow Modeling

In addition to rating the stream crossings, a database was prepared, incorporating topographic and land use data from the entire length of the pipeline, to calculate the probability of a release at any point along the pipeline reaching a surface water body. These data were combined with receptor stream factors to create a separately scored factor for drinking water, recreational use, and agricultural use of waters crossed by the line.

This modeling was done using Digital Elevation Models (DEMs) available in electronic form from the U.S. Geological Survey (USGS). The DEMs provide electronically formatted contour lines. These contours were used to generate a downhill flow path for a leak at any point along the pipeline. Flow paths, or traces, were then generated every 100 meters along the entire length of the pipeline. Two important decisions were made with respect to each trace:

- The likelihood of whether a contaminant trace from a release would reach a surface water body before it could be contained or controlled; and
- Whether the water body it could reach would be considered sensitive.

The first decision is a product of a number of factors—the length of the trace and the terrain slope from the pipeline to the surface water body, and resistance to flow due to land use and cover in the pathway between the pipeline and the surface water body.

The entire pipeline route was divided into 2,515 segments of varying length. In general, segments were drainage-specific, with individual flow traces grouped by receptor water body and by overland flow scoring. The 288 stream crossings along the pipeline were also located within the data set and associated with each trace.

The stationing and overland flow scoring for each segment is maintained electronically. Further discussion is in Appendix 7E.

7.6.3 Methodology

In the identification of environmentally sensitive areas in Chapter 4, surface water bodies were studied with respect to three separate factors in order to determine the vulnerability to spills. Surface water impacts were differentiated based on the flow characteristics of the stream, on the ability of the stream to be isolated for cleanup, and on the downstream water uses.

These three factors, which were determined for each stream crossed by the pipeline, were combined to provide an overall rating of the potential for a release incident causing significant damages to the stream impact categories.

Ability to transport a spill was evaluated as a function of four factors:

- Location along the line;
- Size of water body at crossing;
- Size of watershed; and
- Mean annual flood.

Ability to isolate the spill for cleanup was ranked based on the potential for a spill to be controlled before it entered a major river, or caused contamination of an underlying aquifer. Main river stems with high flows and stream crossings within highly sensitive karst aquifers were assigned a maximum sensitivity rank. Streams above a main river stem, or in the contributing zone to a karst aquifer, were assigned lower risk rankings based on the distance to the aquifer recharge zone or river, and karst or alluvial sensitivity.

7.6.3.1 Combining Stream Sensitivity and Overland Flow

The overland transport scores for each of these segments were combined with the receptor water body sensitivity and used to assist in ranking the surface water sensitivity for each 100-meter stretch along the line.

Drinking Water Sensitivity Scores

Drinking water sensitivity was assigned based on distance from the crossing to the point where the water might be used for drinking water, and the overall importance of that water withdrawals at that point. The following streams were judged to present the greatest risk of contamination of a very important water supply source:

- Streams between Fitzhugh Creek and Buffalo Creek in the Pedernales watershed, with travel distances of less than 50 miles to Lake Travis; and
- Youngblood Creek and Crabapple Creek in the Llano watershed, with travel distances of less than 50 miles to Lake LBJ.

The following streams constituted a second group, posing slightly less risk to drinking water:

- Streams between Hickory Creek up to, but not including, Youngblood Creek, in the Pedernales watershed, with travel distances less than 80 miles to Lake Travis.
- Streams between Sandy Creek and Walton Draw, but not including Rocky Creek, in the Llano watershed, with travel distances less than 80 miles to Lake LBJ.
- Barton, Long Branch, and Slaughter Creeks [Slaughter, for contribution to the Edwards (BFZ)] for their potential to cause contamination of Town Lake in Austin upstream of the Green Water Treatment Plant.
- Crossings of the Pecos River Alluvium and the Colorado River Alluvium deemed to have potential to cause drinking water problems based on proximity of downstream alluvial PWS wells, including the Pecos River crossing, and the crossings of streams in the Onion Creek watershed east of the Edwards Aquifer BFZ recharge area.

A third set of streams, posing even less risk, include:

- Rocky Creek, Gentry Creek, Bear Creek, and West Bear Creek, in the Llano watershed, greater than 90 miles from the Highland Lakes; and
- Crossings of the San Saba watershed, upstream of water rights held by Menard.

Finally, crossings of the Brazos and tributaries, which are less than 60 miles upstream of a major municipal water right held by the Galveston County Water Authority, constitute a fourth category. As described earlier, because of flow rates in the Brazos any impacts to this water right would be expected to be on the order of days in duration.

These ranking determinations for each river or stream crossed by the System are listed in Table 7-6. A scoring of 1-10 was used to rank risk to drinking water, with 10 indicating greatest risk.

Agricultural Impacts

Agricultural impacts are not expected to be major. MTBE is not expected to be problematic for irrigation or livestock purposes, and as described above, benzene is not expected to remain in any watershed for a lengthy period of time.

Recreational Impacts

Recreational uses were evaluated based on specific recreational facilities along the pipeline ROW and those that could be affected by a release of product. From east to west, these are (along with the surface water bodies of concern):

- Buescher State Park (Hunt Creek);
- McKinney Falls State Park (Marble Creek, Onion Creek, Boggy Creek, Slaughter Creek);
- Barton Springs Pool, Town Lake (Long Branch, Barton Creek);
- West Cave Preserve, Hamilton Pool, Hamilton Pool Preserve, Flat Creek, and Pedernales River;
- Pedernales Falls State Park (Pedernales River, creeks in Pedernales watershed upstream of the State Park); and
- Enchanted Rock State Recreation Area (Sandy Creek).

The streams mentioned above were given a maximum score for impacts to recreational areas. The Colorado River was also scored at maximum because this stream segment has been designated as “exceptional” aquatic habitat by the TNRCC and has correspondingly higher water-quality standards. This portion of the lower Colorado River also tends to receive additional recreational use because of the existence of the LCRA Colorado River Trail in this area.

Other rivers and streams which discharge to the Highland Lakes were scored lower, because of potential impacts to the Lakes, although because of dilution and evaporation, impacts to recreational uses of the lakes are expected to be much less than impacts to drinking water. In addition, other major rivers crossed by the pipeline (Brazos, Pecos) were rated for recreational impacts, because of the short-term reduction in water uses and potential kill of recreational fish populations which could result during a major release. These scoring determinations for each river or stream crossed by the System are listed in Table 7-6.

In the case of ignition during a release, the impacts to recreation could be much greater. Ignition of a major release could result in destruction or scorching of recreational facilities and natural areas along the waterway, and could cause temperature changes and remove oxygen from the river or stream, causing fish kills downstream of the release point.

7.6.4 Potential Impacts Analysis

There should be minimal, if any, surface waters impacts associated with the construction and routine operation of the pipeline. Impacts to agricultural use of surface waters following a release of gasoline or crude oil are expected to be minor. A number of minor recreational impacts could occur if a release occurred which contaminated the Colorado or Brazos Rivers, due to temporary suspension of use of these water bodies. Releases to the Highland Lakes could also cause surface slicks which temporarily limit lake usage; it is expected that these impacts would be greater with a release of crude oil than of gasoline, as gasoline concentrations in the environment would more rapidly dissipate due to volatilization.

Adverse impacts could result in the improbable event of a major release at a limited number of sites along the line. These sites include specific crossings upstream of the Highland Lakes, where a very large release of MTBE-enriched refined product could disrupt use of Lake LBJ or Lake Travis water for drinking water purposes. In addition, releases at a number of crossings upstream of public recreation areas, including state parks, state natural resource areas, nature preserves, and Barton Springs Pool, could cause short-term cessation of use of those recreational areas, or at least portions of those areas along the affected streams or rivers.

A complex scoring system was used to identify the sensitive and hypersensitive stretches of pipeline. The results of this scoring are presented in Tables 7-1and 7-2, while details on methodology are in Appendix 7E.

7.6.5 Mitigation Measures

Because the major impacts discussed all involve a release of gasoline or crude oil that would contaminate surface water bodies at and downstream of the pipeline crossing point, any measures that reduce the probability or potential volume of a gasoline release to surface waters would have a positive impact on reducing risk to these resources posed by the pipeline. In particular, capabilities for enhanced detection and location of smaller leaks may be valuable in protecting water resources from the impacts of continuous low volume releases.

In addition, enhanced emergency response could provide an additional factor of safety in the event of a release, in order to reduce the amount of gasoline reaching surface waters from a release, and to reduce the downstream impacts.

7.7 IMPACTS TO AIR QUALITY AND METEOROLOGY

7.7.1 Introduction

Emissions of air contaminants can result from the proposed project in three ways. First, construction of new terminals can result in fugitive dust emissions from soil disturbance, as well as emissions from construction equipment. Second, operation of valves and pump stations along the pipeline, as well as storage facilities at the terminal in El Paso, will result in fugitive emissions of volatile organic compounds (VOCs), including hazardous air pollutants (HAPs), under normal service. Finally, loading of tanker trucks at the El Paso Terminal will result in volatile loadings to the El Paso airshed which currently occur during loading of tanker trucks at refineries and terminals outside of the El Paso airshed.

Noise impacts will also be caused by pipeline construction, maintenance, and from the operation of pump stations.

7.7.2 Potential Impacts

7.7.2.1 Air Quality

The EPA has established National Ambient Air Quality Standards (NAAQS) for six pollutants: ozone, lead, carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and respirable particulate matter ($PM_{2.5}$). Of these contaminants, only the ozone precursor VOC is expected to be emitted during the operation phase of this project. The primary NAAQS are the levels of air quality that EPA judges necessary, with an adequate margin of safety, to protect public health. The secondary NAAQS are the levels that EPA judges necessary to protect the public welfare from any known or anticipated adverse effects. Ozone is not emitted directly into the air but formed through chemical reactions between natural and man-made emissions of VOC and NO_x in the presence of sunlight, and VOC emissions are indirectly regulated through the ozone standards.

In July 1997, the EPA announced a new NAAQS for ground level ozone of 0.125 ppb. Four areas in Texas—Houston-Galveston-Brazoria, Beaumont-Port Arthur, Dallas-Fort Worth, and El Paso—are in non-attainment of the one-hour standard. El Paso is classified as a serious non-attainment area for ozone, with a threshold value of 50 tons per year (tpy) of VOC.

Project emissions were compared to various federal and state emission thresholds to determine applicability to major source classification and potential new source review regulations. New large pollutant sources in areas where the NAAQS are met (all areas except for Houston and El Paso non-attainment areas) are subject to EPA Prevention of Significant Deterioration (PSD) review as administered by the TNRCC. However, the magnitude of project emissions (including fugitives) for the sources within the attainment counties, are well below these major source designation levels, and the proposed sources are not subject to these requirements.

Emissions of VOCs from the El Paso Terminal are estimated at 48.14 tpy in the 72,000 bpd base case, which is under the threshold value of 50 tpy.

The estimated total fugitive emissions of VOC for the El Paso Terminal at the full pipeline operation capacity of 225,000 bpd are projected to be approximately 66 tpy (see Appendix 7F). Since this source is located in a non-attainment area and the VOC emissions exceed the major source threshold for ozone (as VOC) of 50 tpy as the expansion of the pipeline/ terminal progresses, this source will be subject to the Non-attainment New Source Review (NNSR) requirements. These requirements include that this source will need to comply with the Best Available Control Technology (BACT) Lowest Achievable Emission Rate (LAER) for ozone (as VOC).

To comply with LAER emissions from the El Paso Terminal:

- Must not exceed applicable New Source Performance Standards (NSPS) (0.125 ppb of VOC) – (As per emission impact table, El Paso Station has a VOC concentration of 0.479 ppb)*;* and
- Must meet the most stringent limitation contained in the State Implementation Plan or the most stringent emission limitation achieved in practice.

To evaluate potential impacts on air quality, the VOC emissions were estimated based on light liquid petroleum product emission factors provided in the EPA protocol for Equipment Leak Emission Estimates (1995 EPA protocol). To estimate the impacts of those emissions, an atmospheric screening model (SCREEN3) was employed to predict the maximum one-hour ground level concentrations of VOCs under the worst-case conditions. Air quality impacts from the VOC emissions should be minor based on TNRCC's Effects Screening Level (ESL) threshold levels for VOC for all project sources.

Emissions of hazardous air pollutants (HAPs) at the El Paso Terminal were also estimated and modeled. These estimates, for hexane, benzene, toluene, 2,2,4-trimethylpentene, xylene, and ethylbenzene, were based on percentages of VOC emissions from EPA Guidance (EPA – Gasoline Distribution Industry). Combined emissions of HAPs from storage, loading, vapor recovery unit operation, equipment fugitives, and from the oil/water separator, are estimated at 5.34 tons per year (tpy), including 1.06 tpy benzene, 1.93 tpy toluene, and 0.24 tpy ethylbenzene.

7.7.2.2 Noise

Noise impacts may be compared to Housing and Urban Development (HUD) standards of 65 A-weighted decibels (dBA) exterior day-night average sound pressure levels at the nearest noise sensitive receptor. Impacts are therefore a function of local land uses and the timing and duration of the noise generating activities.

Construction impacts are due to the noise generated by construction equipment. Construction impacts will generally last only a few days for any individual receptor and will occur only during daylight hours.

Noise generated from nitrogen purge activities could be quite severe for a short period of time. These impacts could occur at any point in the pipeline in response to future maintenance needs.

Operational impacts, by contrast, will be continuous but limited to areas surrounding pump stations. Noise will be due to pump operation.

7.7.3 Potential Impacts Analysis

7.7.3.1 Air Quality

All emissions from pump stations, valves, and construction of pump stations along the line will be minor in nature. None, including impacts of HAPs, will exceed 10 percent of the Texas Effects Screening Level thresholds, at which the TNRCC projects nuisance or hazardous conditions as a result of an emissions source.

Under the proposed 72,000 bpd startup case, emissions from the tank farm will be minor, as they will not exceed 20 percent of the Texas ESLs, and will not be in excess of the threshold emissions rate for new sources in a non-attainment area.

As the capacity of the line increases, operation of the El Paso Terminal as currently projected will exceed the major source thresholds and require compliance with BACT LAER.

7.7.3.2 Noise

Lands around the Odessa Lateral, the pipeline entering El Paso, and near proposed pump stations are sparsely populated. Similarly, pump stations are not located or planned in areas of high population density. The continuously generated noise will not be greater than 65 A-weighted decibels at any sensitive receptors, although station noise may be audible at some receptors depending on background conditions.

Therefore, no impacts are anticipated from construction or operation of the line. Impacts from nitrogen purges are minor because they are infrequent — and for any location along the line, unlikely — as well as short-term in duration.

7.7.4 Mitigation Measures

In order to remain below the major source threshold levels for the El Paso Terminal as throughput levels increase, Longhorn may need to implement additional controls on fugitive emissions, such as modifications to reduce volatile emissions from storage tanks or from tanker truck loading.

7.8 IMPACTS TO TRANSPORTATION

7.8.1 Introduction

Potential transportation impacts of the System include disruption of traffic flows and access, especially emergency access on roads and railroads influenced by the pipeline. These include roads and railroads crossed by the pipeline, although nearby roads and intersections could be affected by project-related traffic.

7.8.2 Potential Impacts

Transportation effects could include:

- Project-related traffic increases, particularly over the long term, would cause an instability in traffic flow, noticeable congestion, or a substantial increase in average travel time;
- Permanent adverse impacts to roads or rail networks, or other pipeline systems; and
- Emergency access to any portion of the pipeline corridor or segment of a community would be precluded by pipeline construction.

7.8.3 Potential Impacts Analysis

Additional personnel associated with the System operations would minimally affect local transportation activities in Houston, Austin, El Paso, and pump stations and related facilities. The System would be remotely operated; therefore, the number of employees required for routine operations would be limited to periodic site visits for monitoring, maintenance, and repair purposes along the extent of the pipeline.

Gasoline distribution from the El Paso Terminal would be with 8,500-gallon tanker trucks. Projected tanker truck activity at the facility, estimated using information provided in Chapter 2, indicates that approximately 160 tanker trucks daily would be loaded at the facility during initial years of operation. By 2010, tanker truck activity is expected to reach approximately 209 trips per day and by 2020, daily tanker truck trips could reach approximately 248, or more than 10 per hour assuming continuous transport.

In the improbable event of an ignition or large leaks in a densely populated area, temporary traffic impacts would result because of safety concerns and access for emergency response crews. No long-term problems should result from such incidents. No major transportation impacts were identified in this analysis. Most impacts would be minimal and/or of short duration.

7.9 IMPACTS TO LAND USE

7.9.1 Introduction

The System could alter the current and planned land uses along the new pipeline segments and stations. The following analysis is divided into project effects on land use, compatibility with land use regulations and plans, and impacts on recreation facilities and use.

7.9.2 Potential Impacts

Potential impacts from new pipeline or station construction include:

- Proposed development is neither compatible nor consistent with land use plans, regulations, or controls adopted by local, state, or federal governments;
- Agricultural land conversion due to the future Longhorn pipeline pump stations or alternatives results in reduction of 1 percent or more of the agricultural land use of each county;
- Long-term development trends in urban growth patterns are altered;
- Developed recreational facilities, state or national parks, or wildlife refuges have 5 percent or more of their land area permanently altered;
- The quality of recreational activities is decreased because of decreases in game population, increased demand, or any other reason; and
- Pipeline ROW affects the control and safety of exotic species on private.

Of these impacts, only one is rated as a possible consequence of the Proposed Project: several recreational facilities are crossed by the pipeline and could suffer major impacts from a large release, with or without ignition.

A number of stretches of the pipeline cross parks or natural areas, streams contributing to the parks or natural areas. For some of the parks considered, such as Buescher or Pedernales Falls, the major attractions are centered around water-based activities. At Enchanted Rock State Natural Area (SNA), severe impacts to Sandy Creek would in effect cut the facility off from public access until cleanup was completed, even though there is no pipeline crossing of the SNA itself.

7.10 ARCHEOLOGICAL AND PALEONTOLOGICAL RESOURCES

7.10.1 Introduction

Section 106 of the National Historic Preservation Act (36 CFR Part 800) requires that EPA and the DOT consider the effects of the undertaking on cultural resources and afford the Advisory Council on Historic Preservation (ACHP) the opportunity to comment. The ACHP encourages full integration of public participation under Section 106 review with the regulations of other federal agency programs. The EPA's National Environmental Policy Act (NEPA) implementation regulations integrate Section 106 procedures by using established public involvement processes to elicit the views of interested persons [e.g., local governments, Indian tribes and nations (Tonkawa, Comanche, Lipan, Apache, Caddo, Kiowa, Wichita, Tigua, and Mescalero Apache), and the public] with regard to an undertaking and its effects on historic properties.

Programmatic Agreements are appropriate in documenting Section 106 compliance for undertakings where effects cannot be fully determined in advance of federal decision-making. EPA and DOT propose to comply with Section 106 through a Programmatic Agreement on this undertaking, in consultation with the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer (THPO) and the ACHP. EPA and DOT value the views of interested persons and invite the comments on the draft Programmatic Agreement and participation in the Section 106 process in accordance with 36 CFR Part 800.

The draft Programmatic Agreement, developed in consultation with the ACHP, SHPO, and THPOs, is provided for review and comment by interested federal and state agencies, parties, including Tribes and Indian Nations, as a part of this EA process. Review will be made based on comments received, and the final Programmatic Agreement will be executed prior to completion of the EA process. Once the PA is executed (see draft in Appendix 7G) the potential for adverse impacts on cultural resources is eliminated through the stipulations in the Programmatic Agreement.

7.11 OTHER NEPA IMPACT CATEGORIES EVALUATED

Other NEPA categories that were investigated during this study included soils, visual resources, and geology. None of these resources will be damaged under normal operation of the pipeline.

7.12 CUMULATIVE IMPACTS

7.12.1 Cumulative Impacts Description

NEPA regulations (40 CFR 1508.7) define cumulative impacts as impacts that result "from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions."

There will be no cumulative impacts from pipeline construction for the Proposed Project because only 8 miles of lateral line remains to be constructed in El Paso and less than one-half mile in Odessa. Construction along these routes would not exacerbate impacts from other construction because there is no other known construction in the immediate area. There could be cumulative impacts from future pump station construction. These impacts, if any, would be taken into account through a supplemental EA that would be prepared once the exact sites for the new stations have been identified.

Similarly, there are no cumulative impacts from routine System operations because there are no impacts (e.g., significant routine releases of air contaminants, noise, waste discharges, etc.) from such operations.

There are potentially significant impacts that would arise from pipeline failure. In this EA these impacts have been addressed through risk assessment (probability, size, and consequences of spills). At issue, then, is whether there are cumulative increases in risk as a result of other past, present, or reasonably foreseeable impact-causing activities in the vicinity of the pipeline.

Urban and suburban development in west Harris County, and in south and west Travis County have risks of increased future population exposure and third party damage (from road, utility, housing, and building construction). When the Houston-to-Crane EPC line was constructed in 1949 there were very few residences, schools, and other sensitive population receptors within 1,250 ft of the ROW. It is reasonably foreseeable that there will be continued urban and suburban development along the pipeline in the future. Absent land use controls, it is likely that development and the population exposed to the Longhorn pipeline will grow in the future. Longhorn mitigation measures described in Chapter 9 (such as meetings, brochures, public service announcements) will improve public awareness of the presence of the pipeline. This could result in voluntary responses from developers and the public to avoid siting homes and businesses immediately adjacent to the ROW.

7.12.2 Description of Other Pipelines in the Corridor

A second potential cumulative impact from the Proposed Project could arise from the presence of other hazardous liquid pipelines that run parallel to the Longhorn pipeline. At issue is whether there is an increase in risk from multiple pipelines in a common corridor and whether leaks, spills, and fires from one pipeline could trigger a “chain reaction” causing one or more of the other lines to be damaged or result in a release of product. Another concern is that maintenance, repair, or remediation work on one pipeline could result in third party damage to another pipeline.

The Longhorn pipeline shares a general corridor with a two other pipelines along parts of its route across Texas, and in some locales, several other pipelines. The greatest density of proximate pipelines occurs in Harris County. Close proximity of pipelines is common, especially in Texas, Oklahoma, and other states with large hydrocarbon production and process industry sectors.

The Longhorn pipeline runs parallel to the other two pipelines from approximately MP 125 all the way to the vicinity of MP 392 in Crockett County. In the Houston area, especially between MP 0 and MP 9, there are more than a dozen parallel pipelines in a large north-south corridor. The remainder of this discussion focuses on the three-pipeline corridor that accounts for most of the Longhorn pipeline route.

Starting west of Houston and proceeding through Austin and extending west to Crockett County are two pipelines that run in a broad corridor. The two other pipelines are a crude oil pipeline owned by Equilon Pipeline Company, and a natural gas liquids (NGL) line owned by Westex 66 Pipeline Company. Although the exact composition of the product carried in the Westex pipeline can vary, natural gas liquids can contain hydrocarbon liquids ranging from propanes to higher molecular weight liquids, typically butanes and pentanes.

The proximity creates some risk of interaction between the lines in the event of an accident on one of the lines but also provides some benefits with regard to leak detection and third party damage prevention. Concerns for interaction revolve around the belief that an accident in one line could precipitate an accident in one or both of the other lines. The benefits of the Proposed Project on the other two pipelines would result from increased surveillance patrols, public education, and other third party damage avoidance mitigation measures described in Chapter 9.

Given the concerns about population density and environmental sensitivities the locations of the lines relative to each other were examined in some detail for Harris and Travis counties to provide some insight into relative risks.

7.12.3 Cumulative Impact Assessment

7.12.3.1 Potential Adverse Impacts

The primary potential adverse impact of lines in close proximity is the potential that an accident with one line could cause an accident with the other lines. Examination of the DOT database on reported accidents for the years 1986 – 1995 revealed that there were no accidents on a pipeline that caused an accident(s) on an adjacent pipeline(s).

Such occurrences are more likely with high-pressure natural gas pipelines than with hazardous liquid lines for several reasons. When a leak occurs in a high-pressure natural gas line, essentially the total inventory will discharge rapidly or over an extended period of time as the line de-pressures. For liquid there is an initial spurt, followed by a very gradual discharge under the influence of the remaining liquid head in the line. This results in a smaller immediate discharge and one under less driving force for an extended time period. The result is less chance of ignition, less chance of soil erosion around the spill site, and less potential displacement of the pipe. The result is less potential for damage to surrounding pipelines.

The products carried by the pipelines near the Longhorn pipeline could have impacts similar to some of the impacts from the refined products that would be carried by the Longhorn pipeline. Natural gas liquids are highly volatile and flammable. Crude oil has the potential for environmental contamination of soils, surface waters and ground waters, and potential toxic effects on various species.

The potential influence of one line on another will depend on the separation distances between lines. While there are no specific requirements for separation distances in the U.S., flammable liquid storage tanks are have a minimum separation distance of about 50 to 75 ft (NFPA, 1996).

The locations of the Longhorn pipeline and other pipelines were examined in some detail for Harris and Travis counties where safety risks would be greatest. The mileage of shared corridor of one line to the other was determined in each county for two distance size ranges of less than 250 ft and greater than 1,000 ft, as an indicator of which areas might pose the greater risk of potential interaction between pipelines. Of the 50 miles of Longhorn pipeline in Harris County, approximately 9 miles appear to be within 250 ft of another pipeline. Of the 28 miles of Longhorn pipeline in Travis County, approximately 7 miles appear to be within 250 ft of another pipeline.

Multiple lines, of course, result in a higher absolute risk to a receptor than a single pipeline(s) in the same vicinity. Assuming pipelines pose the same risk, the combined risk would be three times the risk of one line. In light of the apparent absence of any pipeline accidents resulting from an adjacent pipeline accident(s) over a 10-year period in the entire United States, despite the existence of many adjacent pipelines, the likelihood of such an accident remains extremely low. In addition, as noted below, there are some ways in which the mitigated Longhorn pipeline can be expected to reduce cumulative safety risks associated with adjacent pipelines.

7.12.4 Potential Benefits of Shared Corridor

Under the proposed Longhorn Mitigation Plan, there will be increased surveillance along the pipeline route. This has the potential to provide some benefit to the other pipelines along the route and contribute to risk reduction for them as well as Longhorn. Likewise, the surveillance of the other lines provides some additional benefit to Longhorn. Unfavorable conditions such as unauthorized third party activity, erosion and exposed pipe conditions and similar situations have an increased chance of being detected. This applies also to actual leaks, where an observer for one system might discover a problem with another.

Increased public awareness from heightened efforts by Longhorn helps the other pipelines and vice versa. Public awareness should deter individuals from irresponsible acts that might threaten the pipelines and also benefits from the public observing conditions in ROW areas and alerting companies of such conditions.

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TABLE OF CONTENTS

LIST OF TABLES

APPENDICES
(See Volume 2)